



Energy and Air Quality

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Integrated Systems Analysis Workgroup
Air Pollution Prevention and Control Division

Outline

Part 1

- Why energy and air quality?
- Is air pollution destined to worsen in the future?
- Would coordinated energy-air quality policies be more effective than when implemented in isolation?

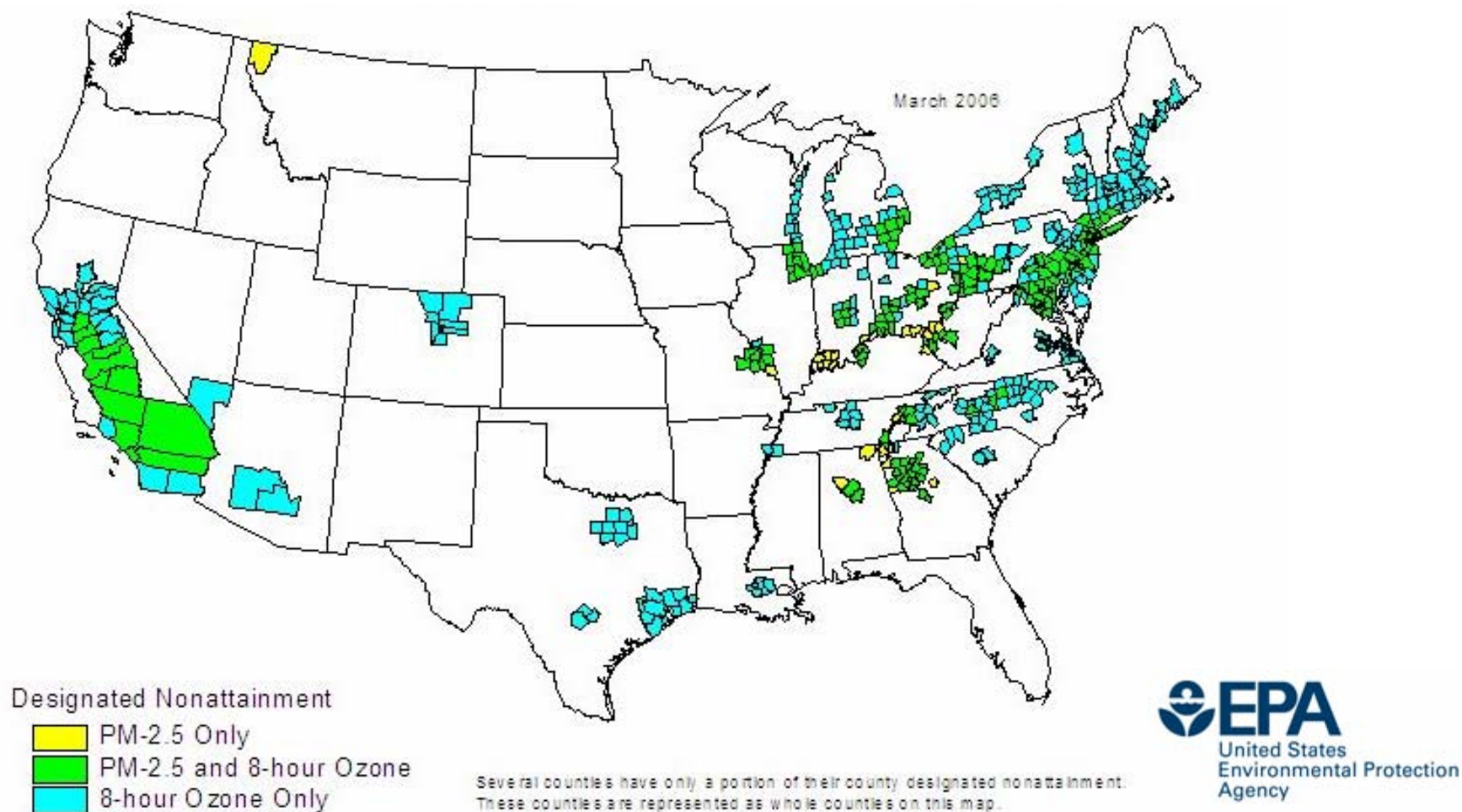
Part 2

- EPA ORD efforts to model linkages between energy system and air quality

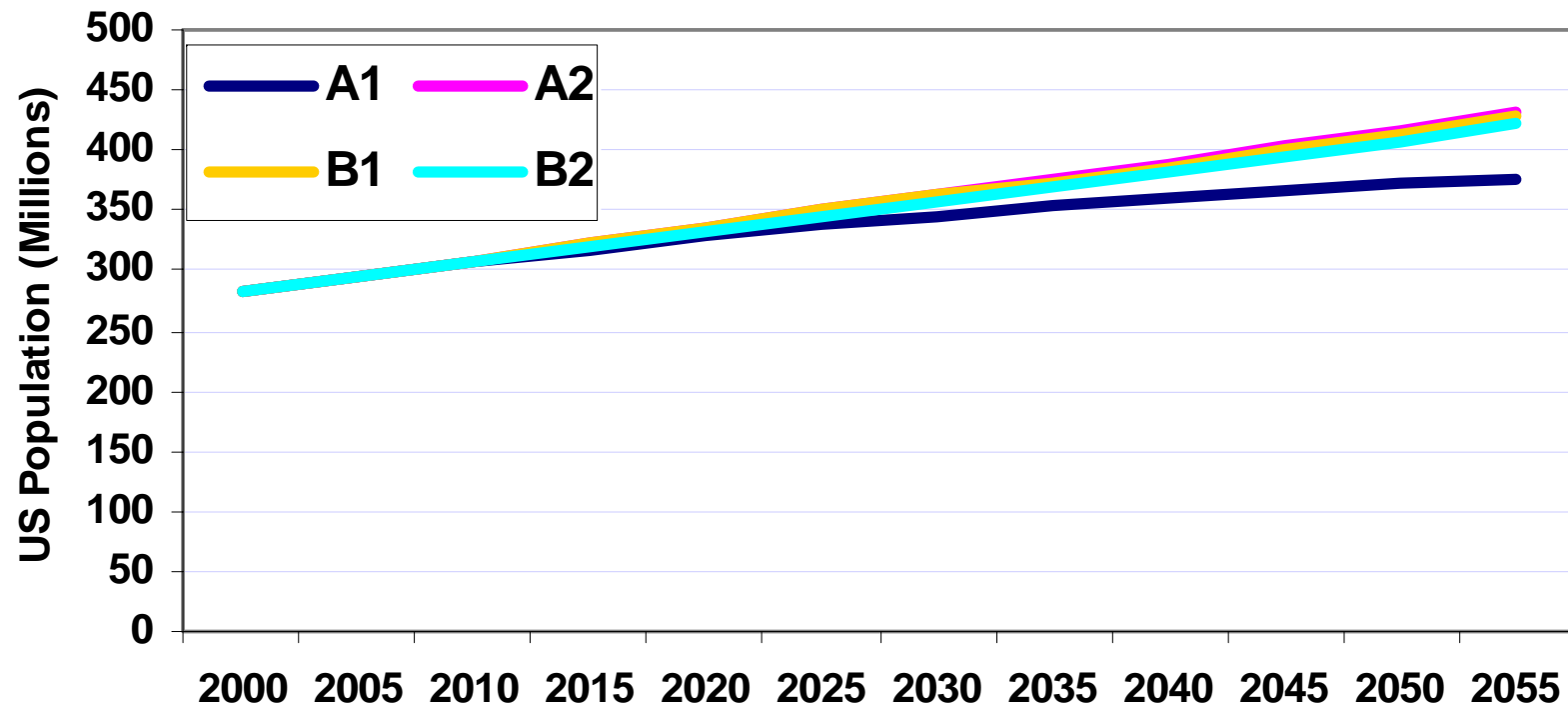
Why energy and air quality?

Air Quality Today

Current non-attainment areas for PM_{2.5} and ozone

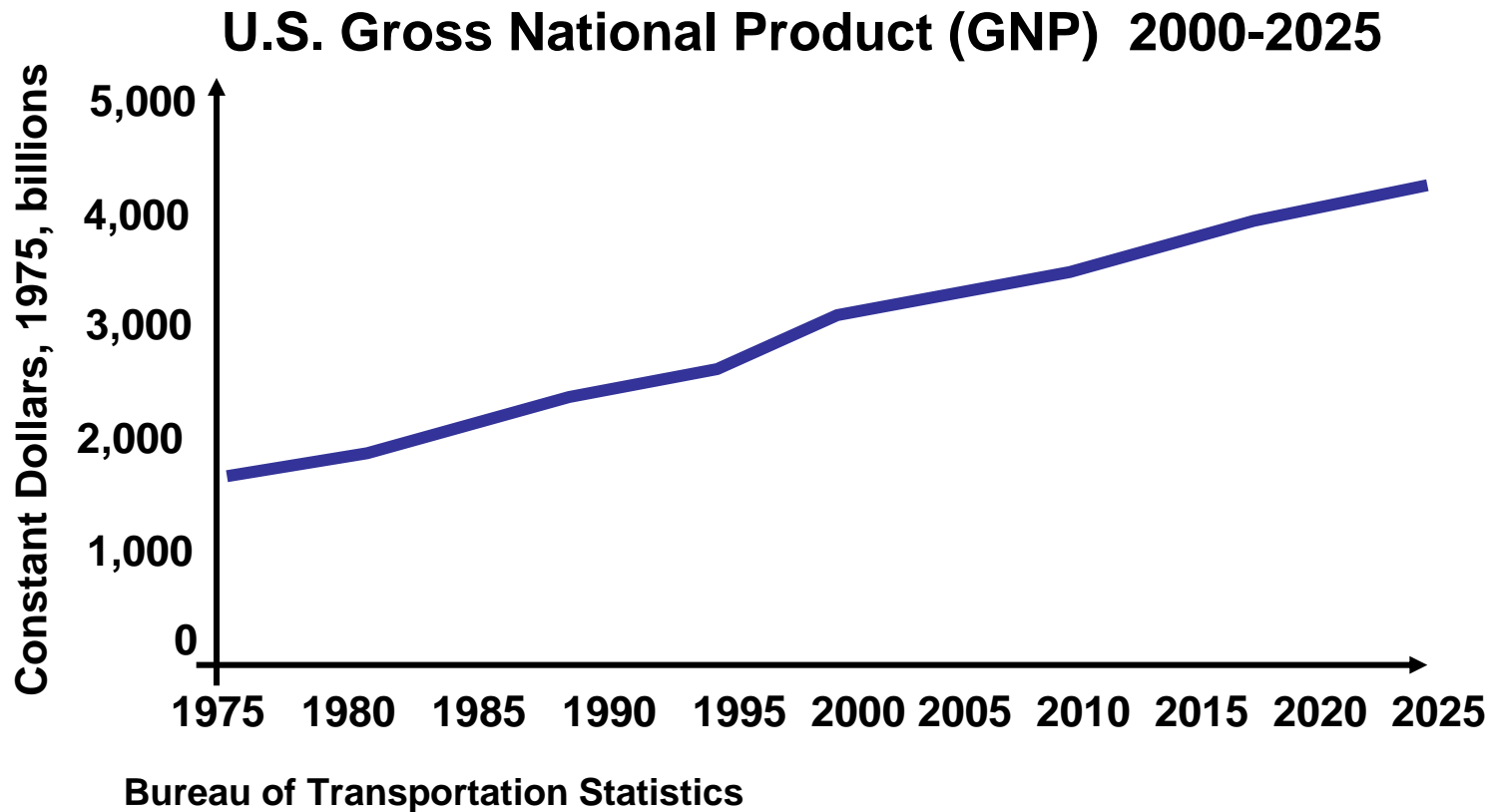


National Population Projections



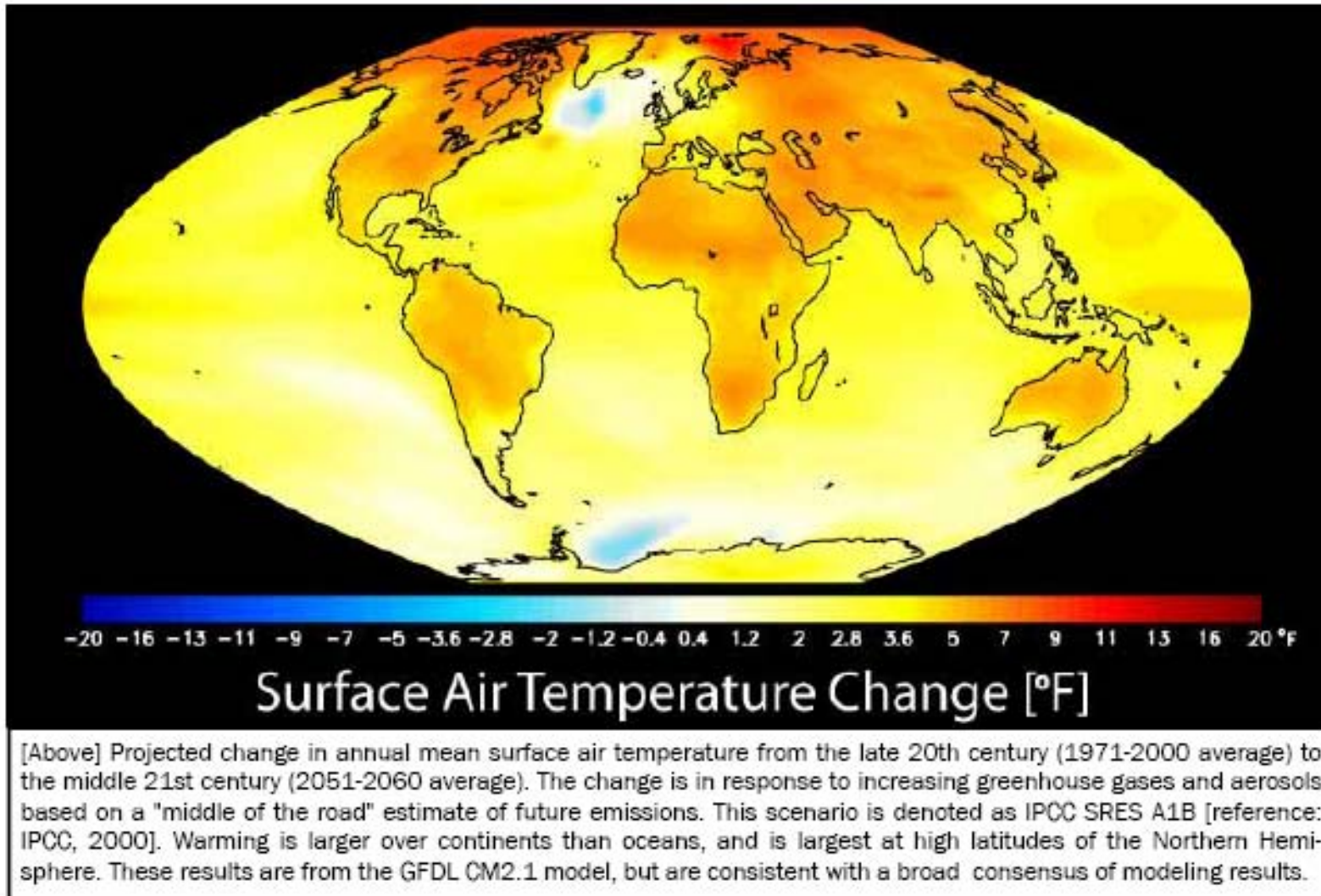
By 2055, increase of between 34% and 54%

Projected Economic Growth



Projected Climate Change

Source:
NASA



Future Energy Service Demands

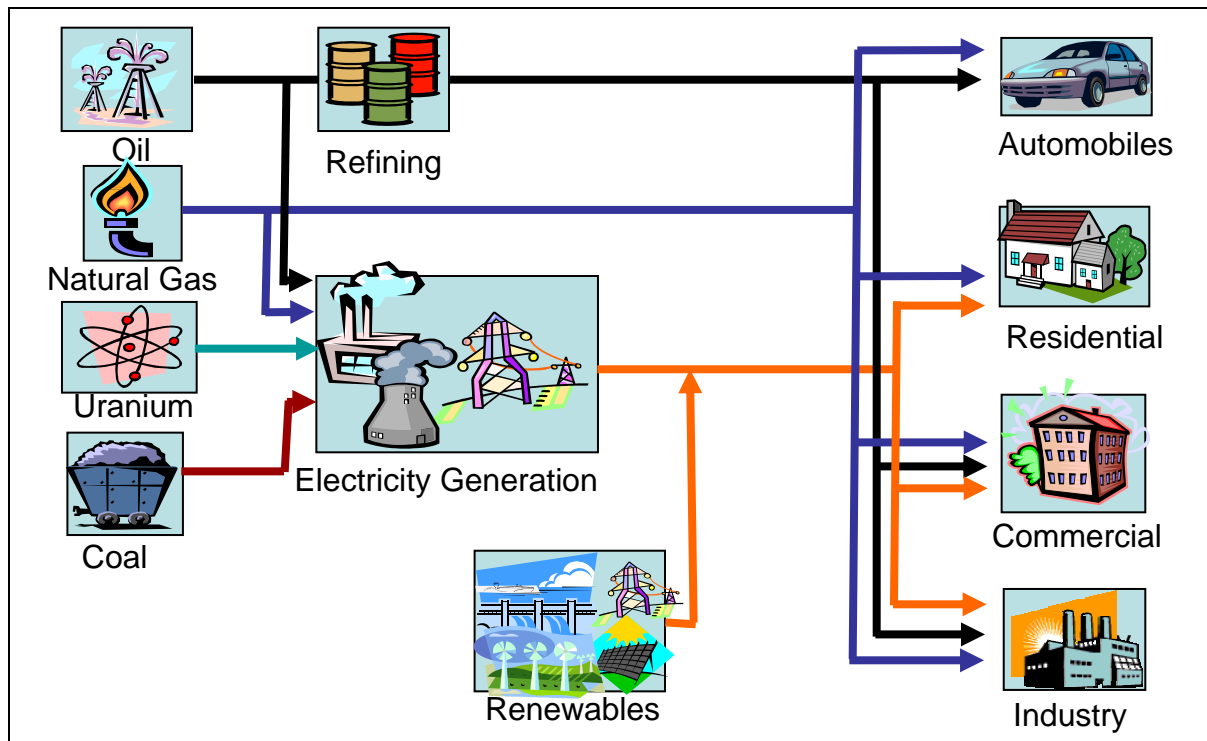
From 2000 to 2030:

(Derived from the DOE's U.S. Annual Energy Outlook)

- Residential cooling demand increase by 115%
- Commercial cooling demand increase by 60%
- Residential heating demand increase by 37%
- Commercial heating demand increase by 30%
- Light duty travel demand increase by 85%

The Energy System and Emissions

Today's energy system



Air Pollution

Contribution to anthropogenic emissions:

NO_x ~ 95%

SO_x ~ 89%

CO ~ 95%

Hg ~ 87%

Air Quality Concerns:

Ozone

PM_{2.5}

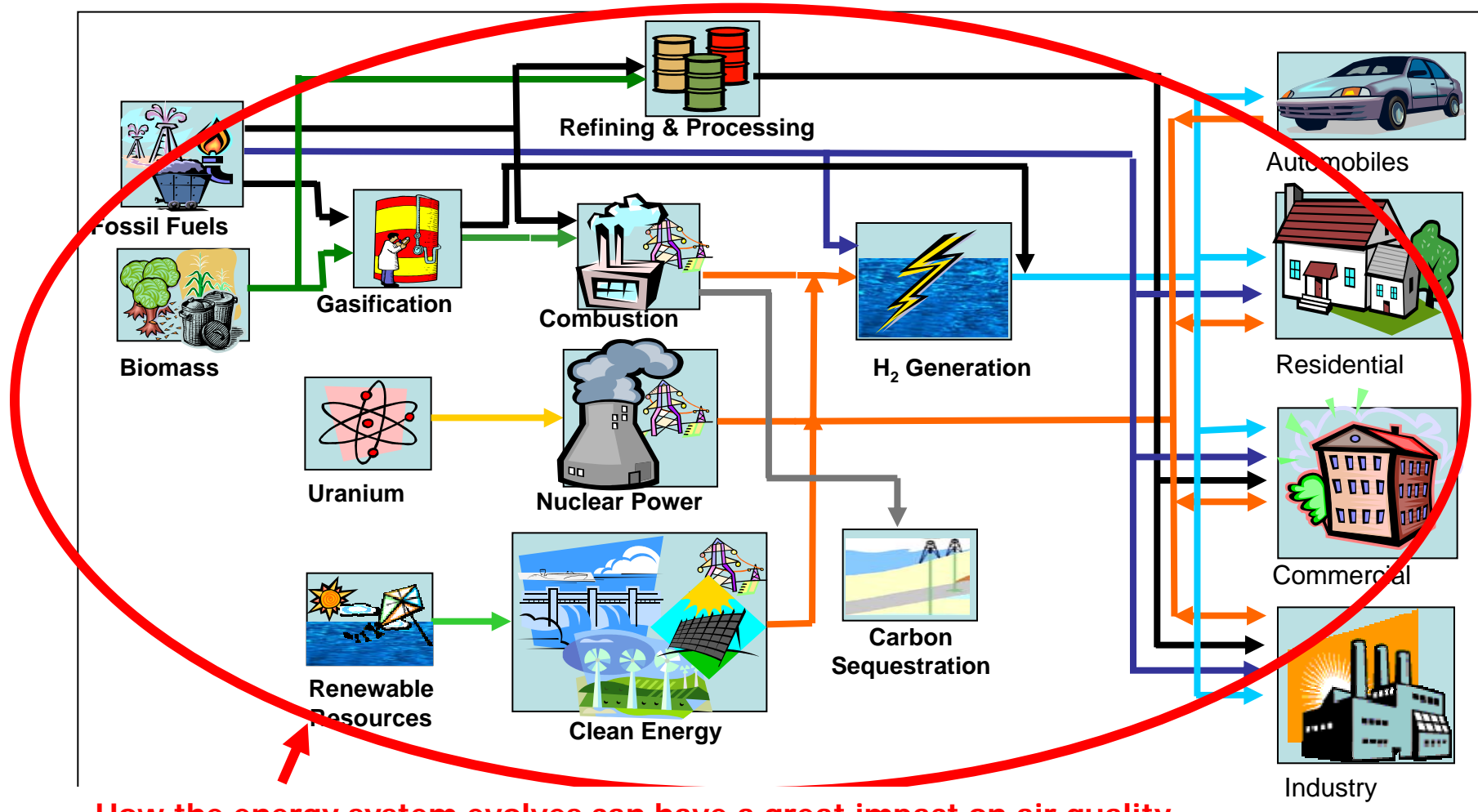
Acid deposition

Toxics

Derived from EPA

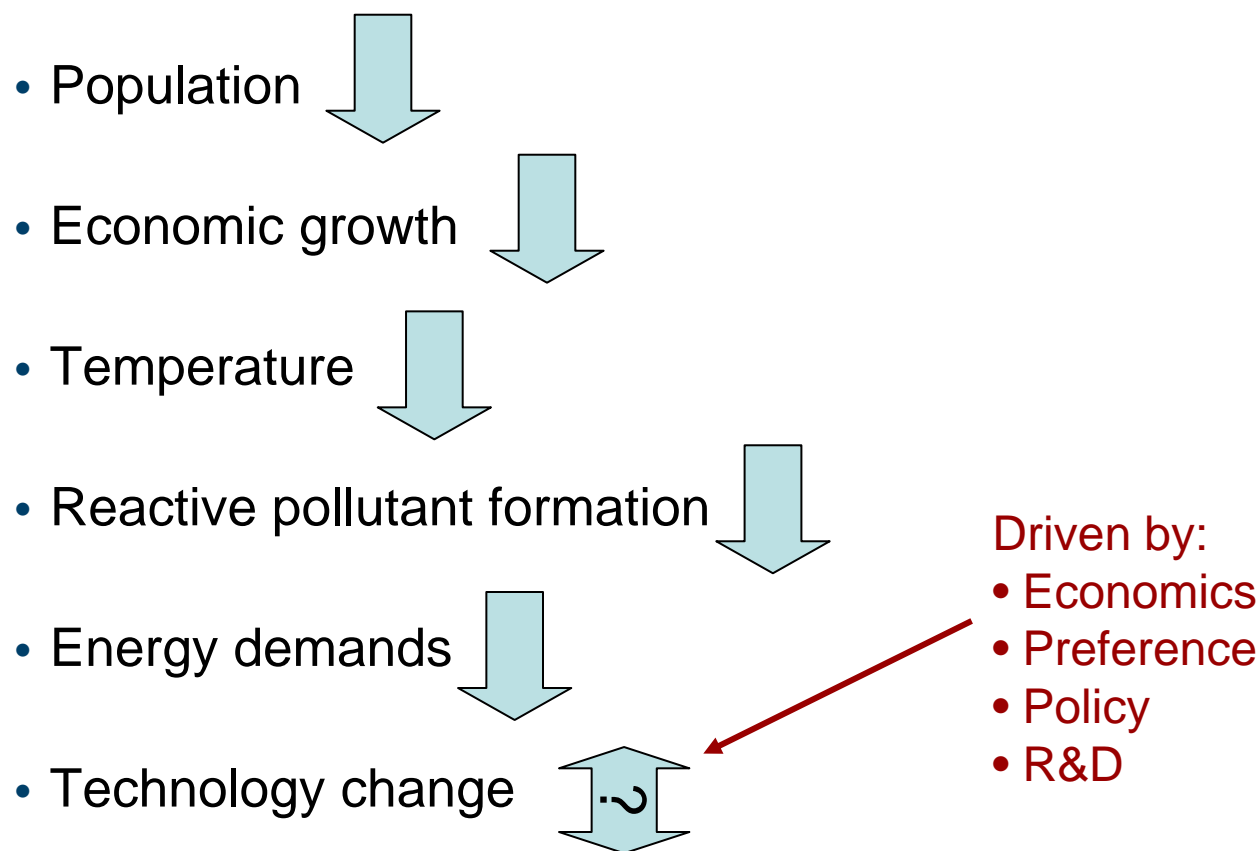
National Emissions Inventory

Potential Role of Technology Change



What about air quality in the future?

Factors affecting future air quality:



Potential Role of Policy

- **Existing Regulations**
 - Clean Air Act Amendments
 - Clean Air Interstate Rule
 - On-Road and Non-road Diesel Rules
 - New Source Performance Standards
 - CAFE
- **Speculation: Possible Policies & Regulations?**
 - More stringent pollutant emissions limits?
 - Climate and/or energy policies?
 - New CAFE standards?
 - Renewable portfolio standards?

Outstanding Questions on Policy

- What impacts do various energy and climate policies have on air quality?
- What impacts do air quality policies have on greenhouse gas emissions?
- Are there benefits in taking a coordinated approach?

ORD Global Change Air Quality Assessment

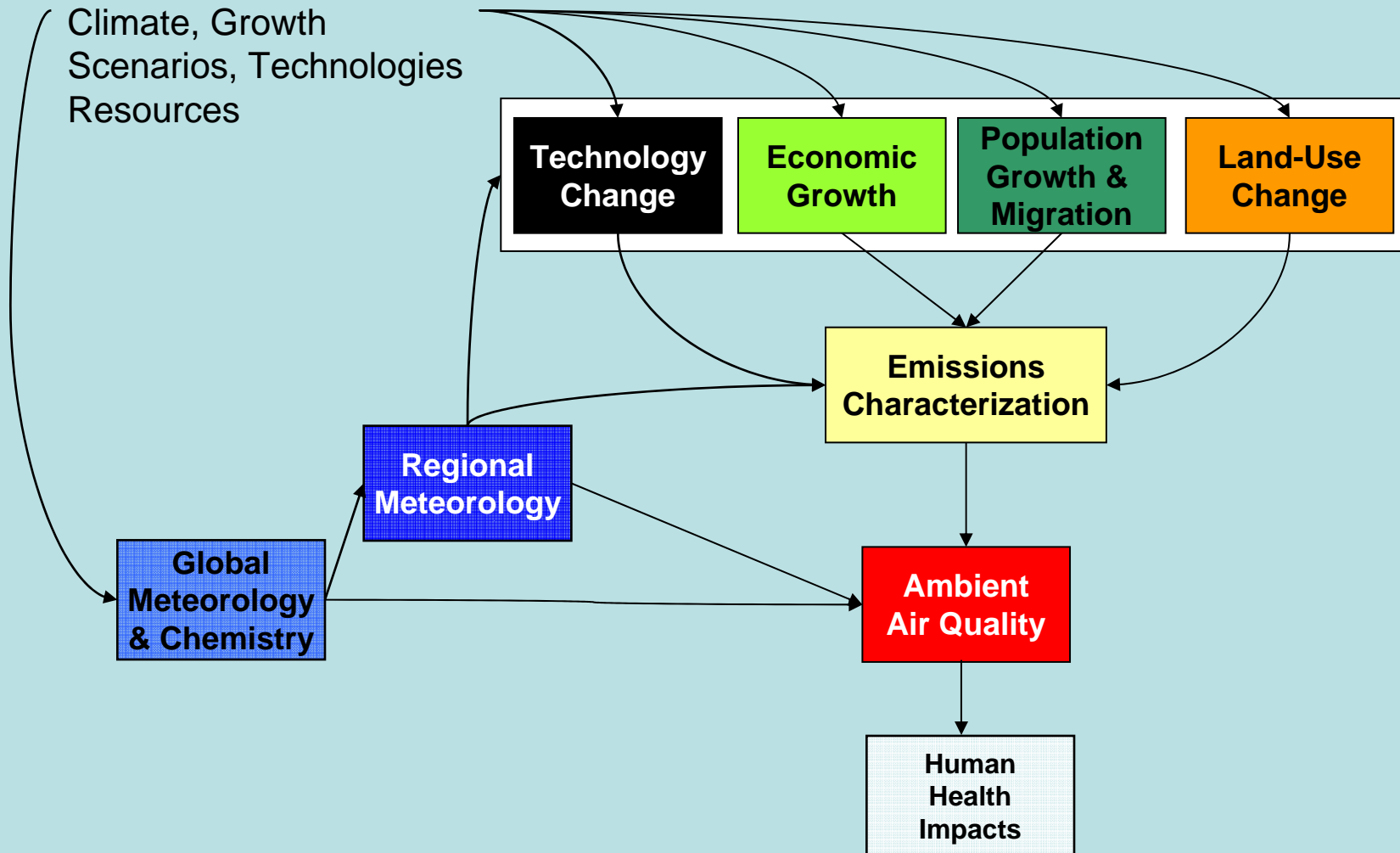
Goals:

- Anticipate potential future air quality concerns
- Develop decision support information and tools to assist federal, regional, state and local decision makers adapt to and mitigate the air quality implications of global change

Integrated Modeling Framework

Scenario Assumptions

Climate, Growth
Scenarios, Technologies
Resources

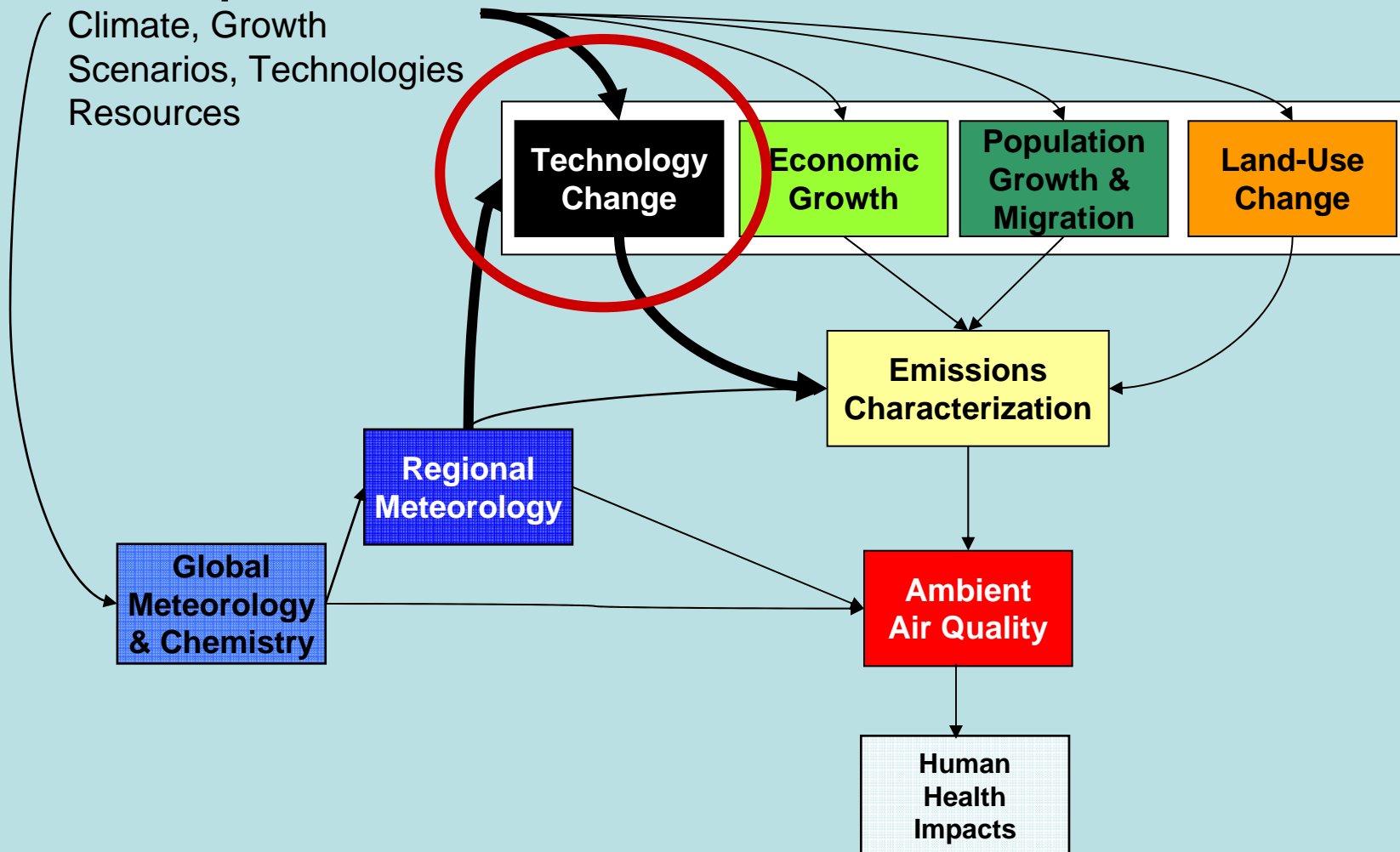


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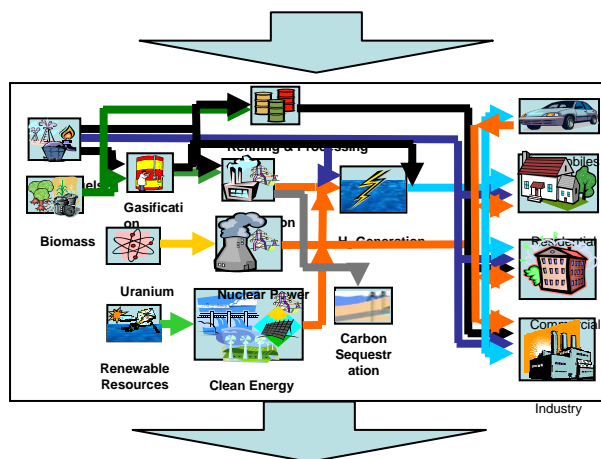
Modeling technology change with MARKAL



Technology Change Modeling: MARKAL

MARKAL Inputs:

- energy service demands
- resource supply cost curves
- current and future technology characteristics
- emissions regulations



MARKAL Outputs (5-yr increments, 2000-2050):

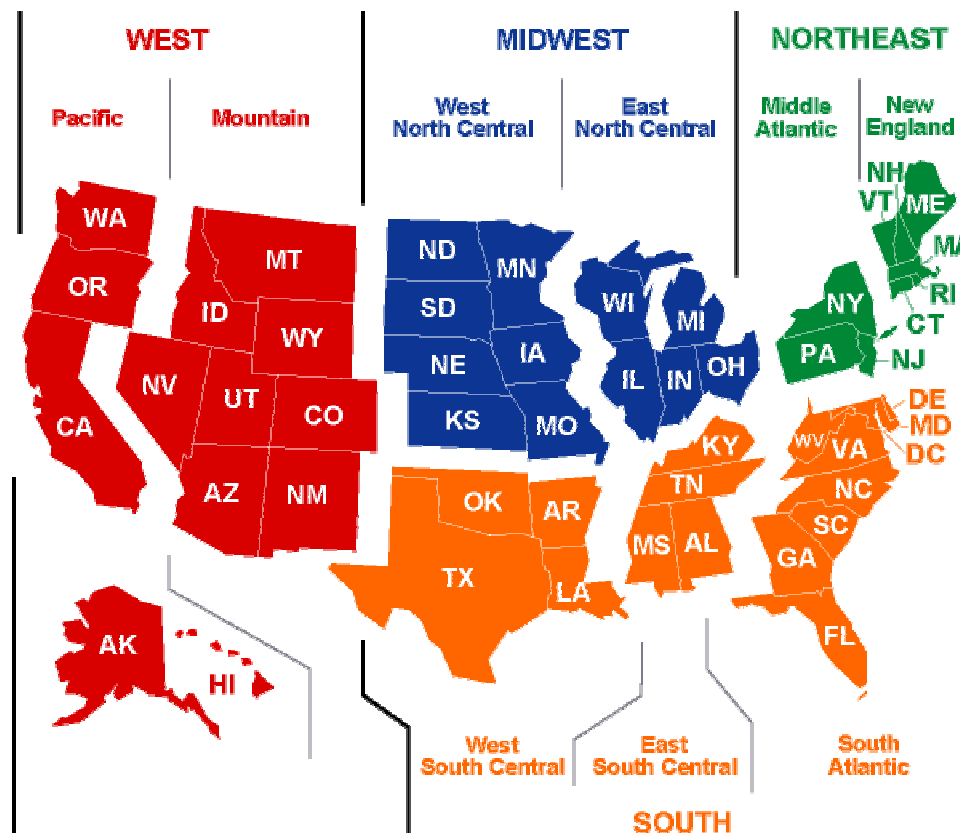
- technology penetrations by demand
- fuel use by type and region

Derived Outputs:

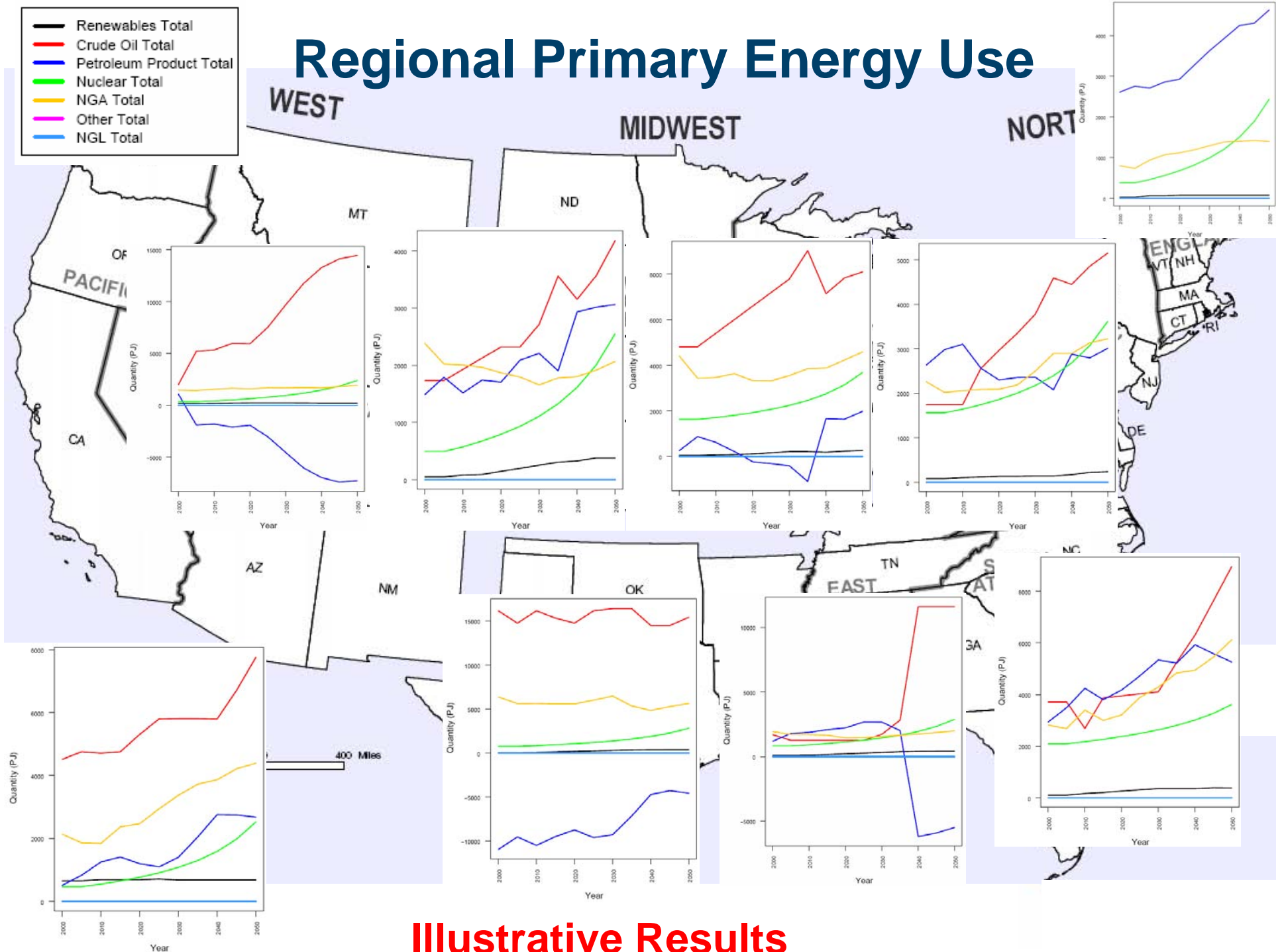
- Emissions growth and control factors for SMOKE

Nine-Region MARKAL Model

- Based on U.S. Census divisions
- Models from 2000 to 2050 in 5-yr increments
- Improve representation of:
 - Coal, oil, and gas supply and transportation costs
 - Renewable energy resources
 - Existing technology stock
 - Technology suitability
 - End-use energy demands
 - Inter-region energy trading
 - Emissions regulations
- Expected public release late 2007 or 2008



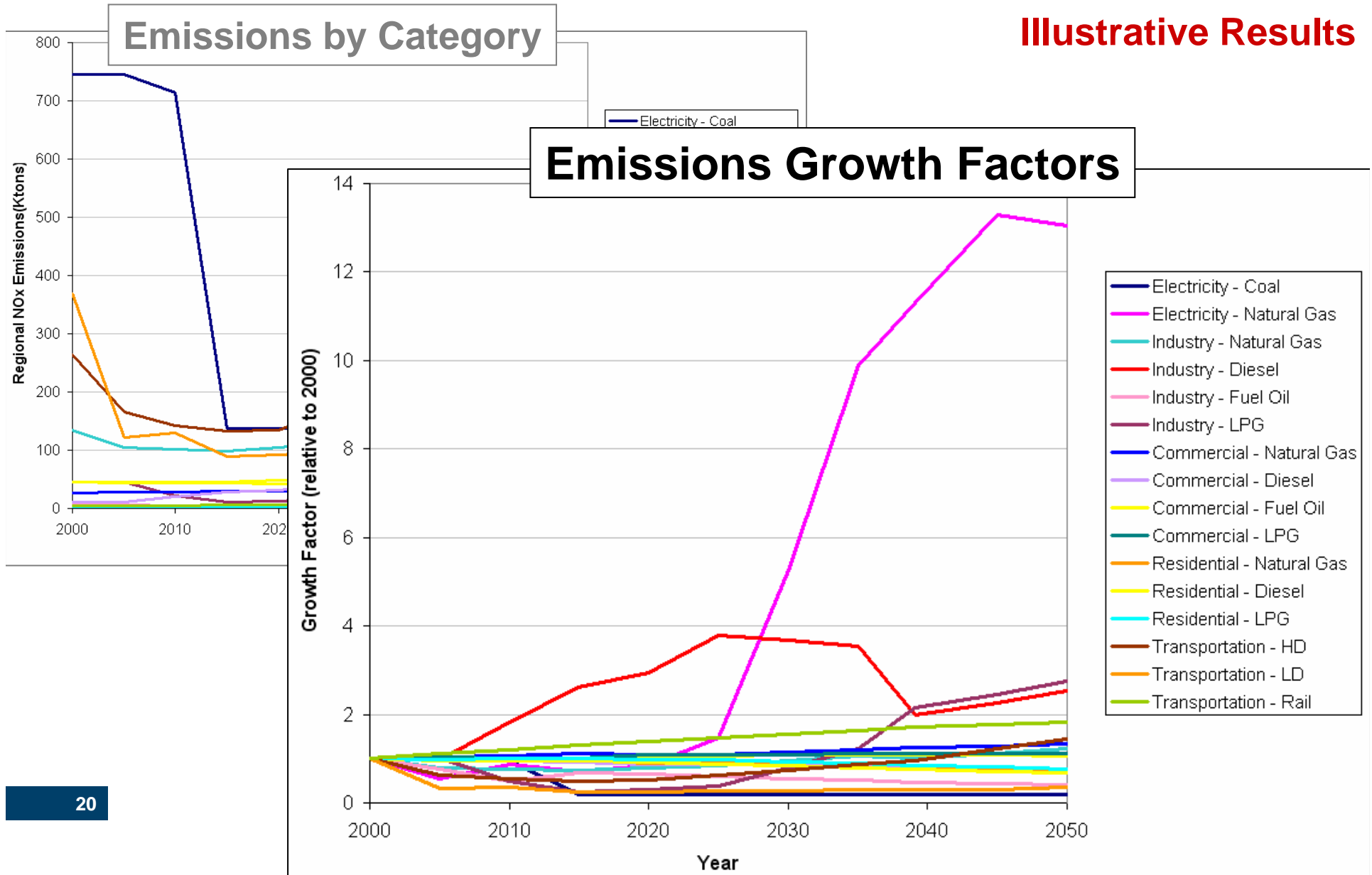
Regional Primary Energy Use



Illustrative Results

Regional Emissions Growth Factors from MARKAL

Illustrative Results

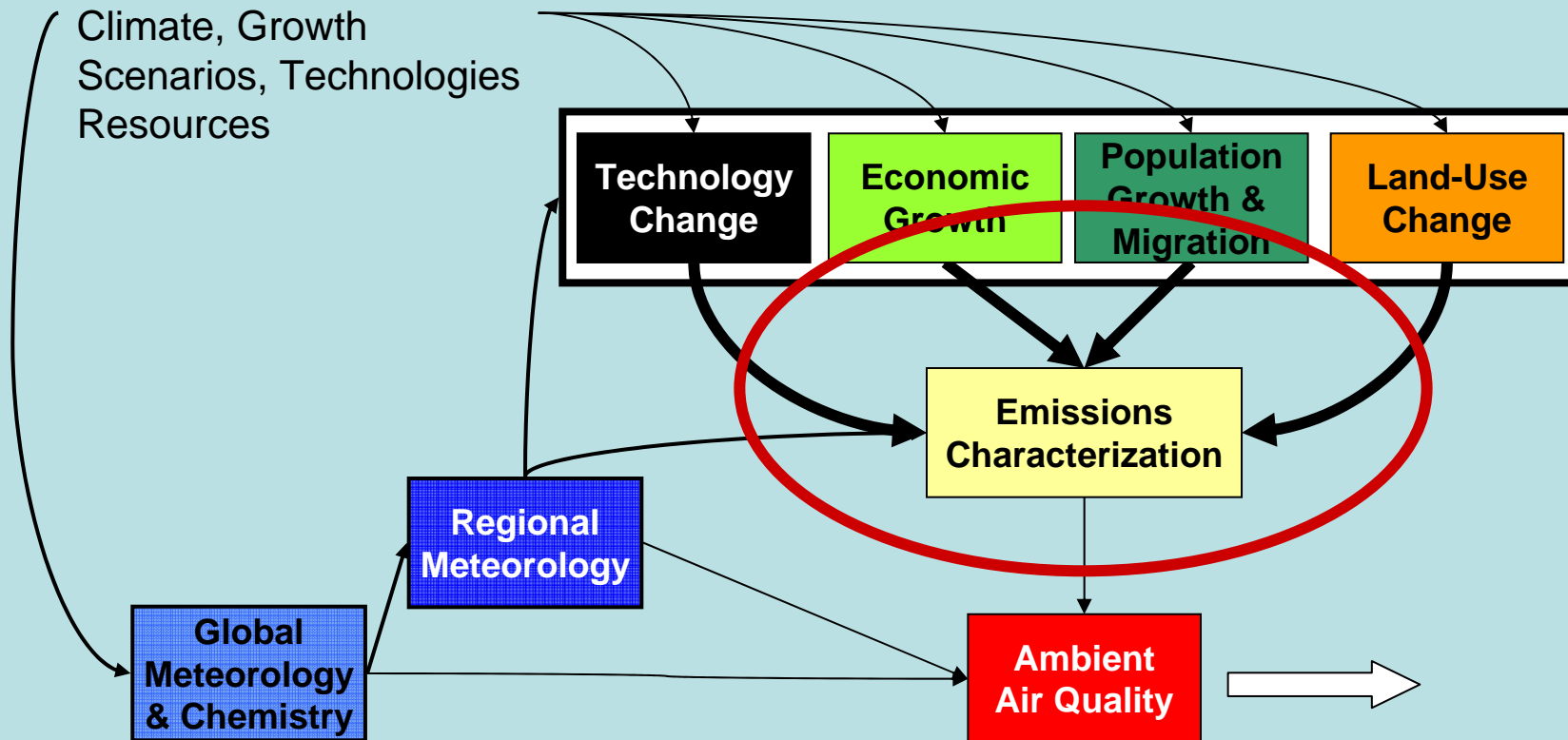


Tying it all Together

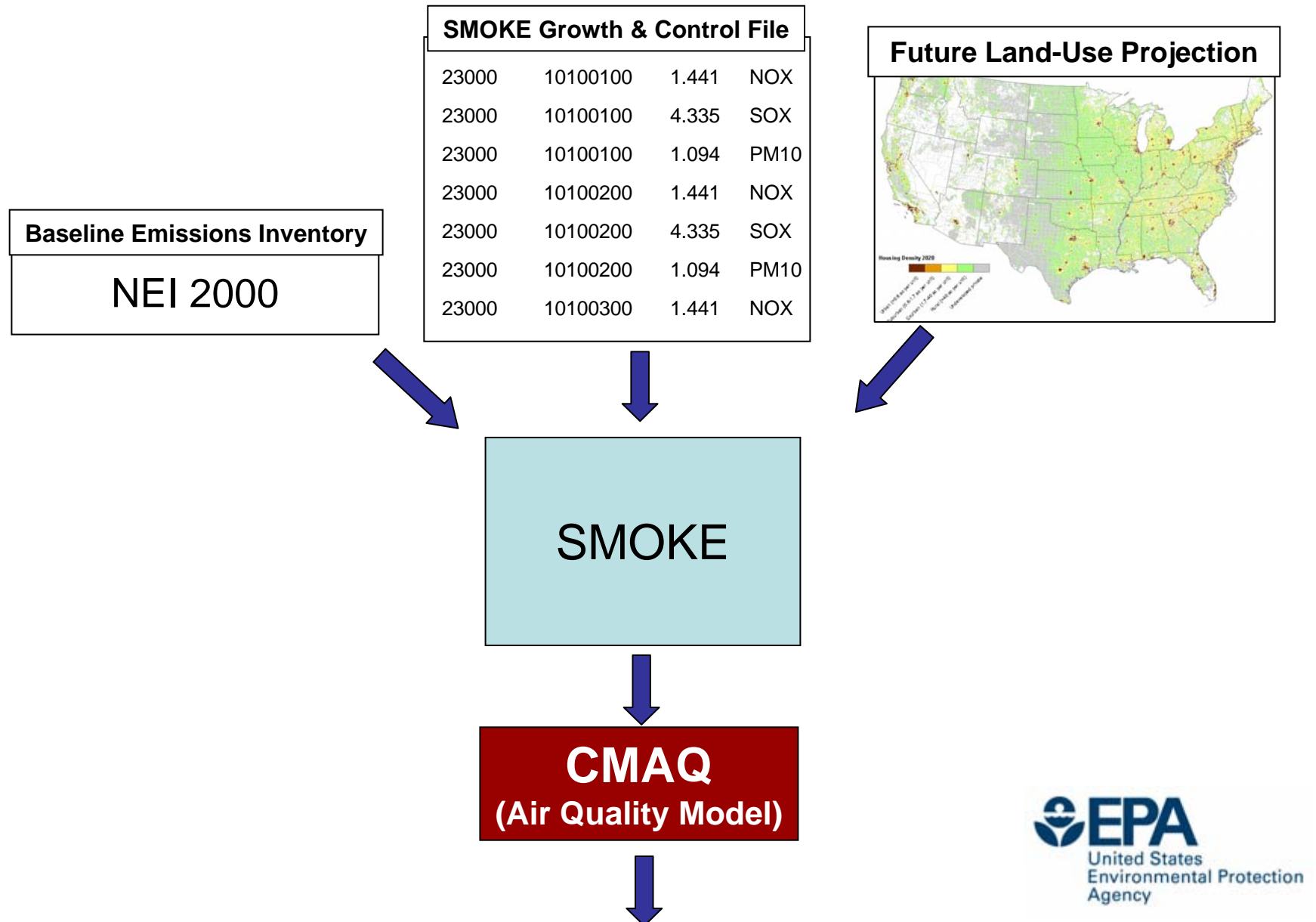
Developing internally consistent, realistic future-year spatially allocated emissions projections

Scenario Assumptions

Climate, Growth
Scenarios, Technologies
Resources



Projections of Anthropogenic Emissions



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